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ORACLE ENTERPRISE BENCHMARK REV. 1.0

ORACLE'S PEOPLESOFT HRMS 9.1 FP2 SELF-SERVICE AND PAYROLL USING ORACLE DB FOR ORACLE SOLARIS (UNICODE) ON AN ORACLE'S SPARC M7-8 with TDE

As a global leader in e-business applications, Oracle is committed to delivering high performance solutions that meet our customers' expectations. Business software must deliver rich functionality with robust performance. This performance must be maintained at volumes that are representative of customer environments.

Oracle benchmarks demonstrate our software's performance characteristics for a range of processing volumes in a specific configuration. Customers and prospects can use this information to determine the software, hardware, and network configurations necessary to support their processing volumes.

The primary objective of our benchmarking effort is to provide as many data points as possible to support this important decision.

SUMMARY OF RESULTS

Extra-Large Data Model Concurrent Benchmark	**PeopleSoft HRMS 9.1 FP2 Self-Service**	
	Average Response	Search 0.55 sec, Save 0.34 sec
	Concurrent Users	35,000
500,480 Employees / Payments 128 Streams	**PeopleSoft HRMS 9.1 FP2 Payroll Batch**	
	Minutes	23.72
	Payments / Hour	1,265,969

Figure 1: Average Response Times (Two Workloads)

BENCHMARK PROFILE

In January 2016, Oracle (PeopleSoft) conducted a benchmark in Burlington, MA to measure the online and batch performance of Oracle's PeopleSoft Enterprise Human Resources Management System (HRMS) 9.1 on Oracle's SPARC M7-8 Server configured with an Oracle VM Server for SPARC (logical domain) LDom of 2 chips. This was configured with (23 cores) for database Oracle Solaris zone (referred to simply as zone hereafter), (16 cores + 16 cores) for Application zones and (7 cores) for the Web zone. The remaining 2 cores were dedicated to network and disk interrupt handling. The database domain was configured with Oracle11*g*™ R2 database running Solaris 11.3. The application and web tiers were configured with 2 zones for PeopleSoft Application Server and one zone for Weblogic server respectively running Oracle Solaris 11.3. Approximately 600 GB of storage (12 TB DB data on 1 × Oracle ZFS Storage ZS3-2 Appliance) and 200 GB of storage (6.4 TB redo logs on 1 × Oracle Server X5-2L) was allocated to the database instance. Note that the benchmark was run with Oracle Advanced Security Transparent Data Encryption (TDE) active. TDE uses Oracle's SPARC M7 processor's 'software in silicon' cryptography instructions for efficiency.

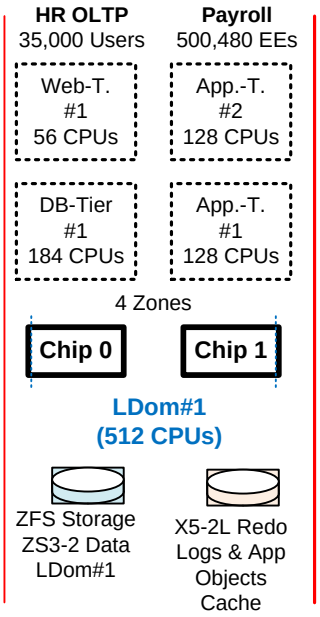

Figure 1: Virtualization Resource Apportionment

The benchmark measured client response times for a total of 35,000 concurrent users with concurrent Payroll batch executions for a total of 500,480 employees. The standard database composition model represents an extra-large-sized company profile. The testing was conducted in a controlled environment with no other applications running. **The goal of this Benchmark was to obtain baseline results for PeopleSoft HRMS 9.1 FP2 self-service and batch transactions with Oracle Database for Solaris on Oracle's SPARC M7 Servers with TDE.**

This report summarizing concurrent OLTP and batch processing in HCM 9.1 FP2 on this particular hardware and software environment is the baseline. Two complementary reports cover stand-alone batch and stand-alone OLTP results on this same environment for further performance analysis.

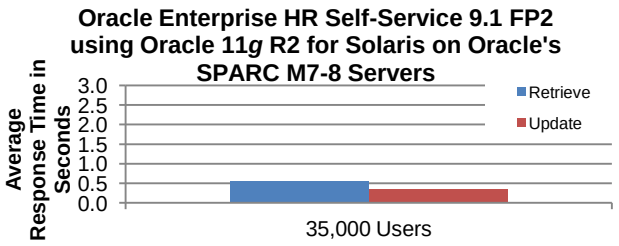

Figure 2: Average Response Times

* This average is weighted based on the business mix as reflected in Table 1: Business Process Mix.

METHODOLOGY

Oracle® ATS™ was used as the load driver, simulating concurrent users. It submitted a business process at an average rate of one every five minutes for each concurrent user.

Measurements were recorded when the user load was attained and the environment reached a steady state.

Figure 3 shows a typical 4-tier benchmark configuration.

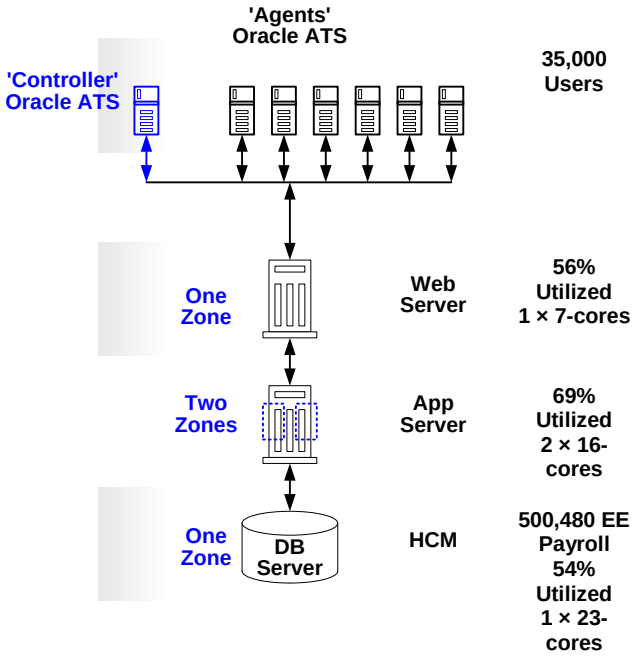

Figure 3: 4-Tier Configuration

Load (search/retrieval) times were measured from the time the user clicks the <OK> button until all the data for the entire business transaction has been retrieved.

Update (save) times were measured from the time the user clicks the <SAVE> button until the system has released the page.

ONLINE BUSINESS PROCESSES

Oracle (PeopleSoft) defines a business transaction as a series of HTML pages that guide a user through a particular scenario, such as promoting an employee.

The fourteen PeopleSoft Enterprise 9.1 FP2 HRMS business processes tested in this benchmark are as follows:

EMPLOYEE SELF-SERVICE

eProfile

Update Home Address: Update address in Personal Data section.

Update Home Phone: Update phone number in Personal Data section.

eBenefits

View Benefits Summary: View overall benefits enrollment data.

Benefits Change Life: View benefits and alter the beneficiaries' allocations in the Basic Life Plan.

ePay

View Paycheck: View current paycheck information.

Update Direct Deposit Info: Add a direct deposit directive.

Employee Adds Profile Items: Add competencies to personnel profile.

MANAGER SELF-SERVICE

eDevelopment

View Employee Info: View job and personal information.

eProfile

Initiate Termination: Initiate a termination by recording an effective date and reason for termination.

Initiate Promotion: Initiate a promotion by entering a new job title and salary.

eCompensation

Initiate Employee Salary Change: Process a salary change for a single employee.

HR ADMINISTRATION

Add a Person: Add a person and their biographical details.

Hire a Person: Enter the specified job data and work location, followed by the payroll and compensation details.

Add a Job: Add job details to an existing employee.

HRMS Process	% within Group	% Overall	Pacing in Min
Employee Self-Service (60%)			
Update Home Address	3%	1.8%	5
Update Phone Numbers	3%	1.8%	5
View Benefits Summary	10%	6%	5
Update Beneficiary	2%	1.2%	5
View Paycheck	78%	46.8%	5
Update Direct Deposit	2%	1.2%	5
Employee Adds Profile Items	2%	1.2%	5
Manager Self-Service (20%)			
View Employee Info	50%	10%	5
Initiate Termination	20%	4%	5
Initiate Promotion	10%	2%	5
Initiate Employee Salary Change	20%	4%	5
HR Administrator (20%)			
Add a Person	20%	4%	5
Hire a Person	40%	8%	5
Add a Job Row	40%	8%	5
Total		100%	5

Table 1: Business Process Mix

The table above shows the proportions of the business processes used in the measurements of this benchmark. The proportions are intended to simulate a typical user scenario.

The database and application servers were processing a total of 7,000 business processes per minute at the peak load of 35,000 concurrent users. The estimated transaction rate is calculated by dividing the total number of concurrent users by the average pacing rate.

Performance may vary on other hardware and software platforms and with other data composition models.

ONLINE PROCESS RESULTS

The table below shows average retrieval (search) and update (save) times, in seconds, for each business process.

Process		35,000 Users
Update Home Address	Search	0.529
	Save	0.773
Update Home Phone	Search	0.42
	Save	0.357
View Benefits Summary	View	0.523
Update Beneficiary	Search	0.513
	Save 1	0.071
	Save 2	0.105
	Edit/ Calc	0.056
View Paycheck	Search	0.552
	View	0.499
Update Direct Deposit Info	Search	0.413
	Save	0.079
Employee Adds Profile Items	Search	0.354
	Save	0.836
	Submit	3.057
	Confirm	0.712
View Employee Info	Search	0.605
Initiate Termination	Search	0.567
	Save	0.055
	Confirm	0.038
Initiate Promotion	Search	0.615
	Save	0.656
Initiate Salary Change	Search	0.673
	Save	1.387
	Calc	0.254
Add a Person	Save	0.075
	Confirm	0.158
Hire a Person	Save 1	0.078
	Save 2	0.066
	Confirm	0.361
Add a Job	Search	0.477
	Save	0.496
	Confirm	0.129
* Average Search		0.550
* Average Save		0.341
Trans/min Est.		7,000

Table 2: Employee/Manager Process Runtimes

BATCH BUSINESS PROCESSES

The five Payroll processes tested are as follows:

Paysheet Creation: Generates payroll data worksheets for employees, consisting of standard payroll information for each employee for the given pay cycle. The Paysheet process can be run separately from the other two tasks, usually before the end of the pay period.

Payroll Calculation: Looks at Paysheets and calculates checks for those employees. Payroll Calculation can be run any number of times throughout the pay period. The first run will do most of the processing, while each successive run updates only the calculated totals of changed items. This iterative design minimizes the time required to calculate a payroll, as well as the processing resources required. In this benchmark, Payroll Calculation was run only once, as though at the end of a pay period.

Payroll Confirmation: Takes the information generated by Payroll Calculation and updates the employees' balances with the calculated amounts. The system assigns check numbers at this time and creates direct deposit records. Confirm can only be run once, and therefore, must be run at the end of the pay period.

Print Advice Forms: This process takes the information generated by Payroll Calculation and Confirmation and produces an Advice for each employee to report Earnings, Taxes, Deductions, net pay and bank accounts where Net Pay were sent.

Create Direct Deposit File: This process takes the information generated by Payroll Calculation and Confirmation and produces an electronic transmittal file used to transfer payroll funds directly into an employee's bank account.

BATCH RESULTS

The table below contains the actual runtimes, in minutes, for the Payroll processes. It also shows how many employees were processed and the number of checks and advices produced.

	LDom1
Job Streams	**128**
Single Check	**No**
Employees	*500,480*
Jobs	*500,480*
PayCheck	*0*
PayAdvice	*500,480*
Payments	*500,480*
Paysheet	1.43
PayCalc	13.22
PayConfirm	9.07
Total Minutes	23.72
Total Hours	0.4
Print Advice	5.63
Direct Deposit	0.53
Total Minutes	6.16

Table 3: PeopleSoft 9.1 FP2 Payroll Process Runtimes

	LDom1
Job Streams	**128**
Single Check	**No**
Paysheet	20,999.160
PayCalc	2,271,467
PayConfirm	3,310,782
Net per Hour	1,265,969
Print Advice	5,333,712
Direct Deposit	56,658,113

Table 4: PeopleSoft 9.1 FP2 Payroll Process Throughputs

The throughputs above are linear extrapolations only. For Paysheet, PayCalc and PayConfirm the throughputs are payments per hour. For Print Advice and Direct Deposit, throughputs are PayAdvice per hour. Performance may vary on other hardware and software platforms and with other data composition models.

SERVER PERFORMANCE

Figure 4 shows the average CPU utilization for the database server. The CPU utilization is the average across all of the CPUs. Notice that the OLTP ramp-up and ramp-down phases clearly book-end the batch execution. The three 'Payroll' batch processes are in the dark color, followed by the 'Print Advice' and brief 'Direct Deposit' processes in the light color.

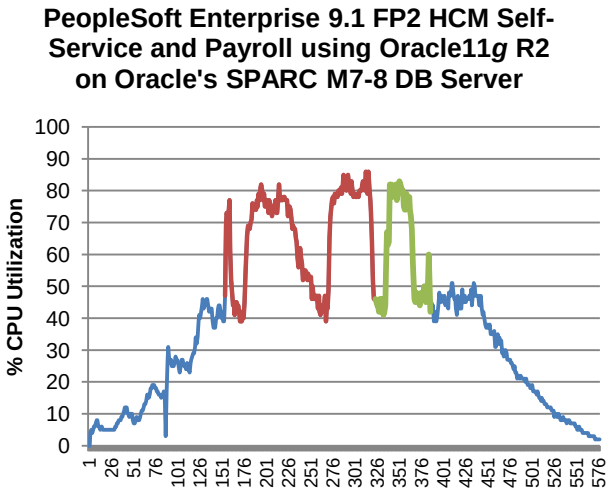

Figure 4: Average Server CPU Utilization

% CPU	LDom		User	System	Idle
DB Server					
PaySheet	LDom1		51	9	40
PayCalc	LDom1		64	9	27
PayConfirm	LDom1		74	12	14
Print Advice	LDom1		66	12	22
Direct Dep.	LDom1		20	5	75
App Server					
All Process.	LDom1		62	7	31
Web Server					
All Process.	LDom1		47	9	44

Table 5: Summary of CPU Utilization

	LDom1
DB Server	364 GB
App Server	347 GB
Web Server	49 GB

Table 6: Average Memory Utilization

I/O PERFORMANCE

An Oracle ZFS Storage ZS3-2 Appliance was used for storage of tables and indexes. An Oracle Server X5-2L with NVMe was used for storage of redo logs. I/O performance is crucial to performance and is summarized as follows:

vUsers →	LDom1
DB	**Average**
r/s	1,345
w/s	4,227
MB r/s	14.02
MB w/s	36.26
Service Time (ms)	0.66
DB Redo	
w/s	2,463
MB w/s	25.33
Service Time (ms)	0.0
App Cache	
r/s	2,879
w/s	1,655
MB r/s	78.39
MB w/s	26.49
Service Time (ms)	0.38

Table 7: I/O Metrics

DATA COMPOSITION DESCRIPTION OF EACH DATABASE

There are 500,480 active employees and each employee has eleven months of payroll history. Within the active employee population, there are a total of 500,480 Jobs from which the active employees receive compensation. In this benchmark there are a total of 500,480 payments.

The employees were distributed over four monthly, semi-monthly, bi-weekly and weekly pay groups. Each of these four pay groups was assigned to 32 pay groups for a total of 128 pay groups. With further sub-divisions, the benchmark was set up for 128 concurrent processes for the Paysheet, PayCalc and PayConfirm processes for this test. The employee profiles are as follows:

Employee ID	Pay Group	Pay Freq.	Employee Type	Employee Status
KU0200	PB1	Weekly	Hourly	PT 20 Hrs
KU0202, ER0	PB4	Monthly	Salaried	PT 30 Hrs
KU0202, ER1	PB2	Bi-Weekly	Exc Hourly	PT 10 Hrs
KU0203	PB4	Monthly	Salaried	FT
KU0204	PB2	Bi-Weekly	Salaried	FT
KU0205	PB3	Semi-Mon.	Salaried	FT
KU0208, ER0	PB1	Weekly	Salaried	PT 20 Hrs
KU0209	PB3	Semi-Mon.	Hourly	FT

Table 8: Employee Profiles for Seed Data

- Part-time, hourly paid weekly with one additional pay, with Federal and California State tax, two general deductions and eight per pay period benefit deductions, one garnishment (KU0200).

- One Part-time salaried and paid monthly with one additional pay, with Federal and California State tax, one general deduction, three garnishments and seven per pay period benefit deductions with Absence Management (KU0202 ER0).

- One Part-time exception hourly paid bi-weekly with one additional pay, with Federal and California State tax, one general deduction, three garnishments and seven per pay period benefit deductions with Absence Management (KU0202 ER1).

- Full-time salaried paid monthly with Federal, New Jersey and New York State tax and New Jersey local tax, with five benefit deductions and no general deductions with Absence Management (KU0203).

- Full time, salaried paid biweekly with Federal and Pennsylvania State tax and seven per pay period benefit deductions (KU0204).

- Full time, salaried paid semi-monthly with one additional pay, with Federal and Michigan State tax, five per pay period benefit deductions, with Time and Labor (KU0205).

- One Part-time salaried paid weekly with one additional pay, with Federal and Georgia State tax, seven per pay period benefit deductions and one general deduction with Absence Management and Time and Labor (KU0208 ER0).

- Full time, hourly paid semi-monthly with one additional pay, with Federal and California State tax, seven per pay period benefit deductions and no general deductions (KU0209)

The benchmarking payroll Pay_End_Dt is Dec 9th (PB1 weekly), Dec 16th (PB2 bi-weekly), Dec 15th (PB3 semi-monthly), or Dec 31st (PB4 monthly). The database reflects ~11 months history in calendar year 2006.

Note that this 'Data Model' has been revised from that used for Release 9.1. Direct comparison between this result and results published for earlier releases is impossible.

OLTP DATA COMPOSITION DESCRIPTION OF EACH DATABASE

The standard database was comprised of:

- 500,480 Employees (8 per Department)
- 62,560 Managers
- 62,560 Department Table Entries

BENCHMARK ENVIRONMENT

HARDWARE CONFIGURATION (SPARC M7-8)

Database Server:

1 × Oracle Solaris Zone with 23 cores on an Oracle's SPARC M7-8 server was used as a database server. It was equipped with the following:

- 1 × 4.13 GHz SPARC™ M7 Thirty-Two Core processors each with 16 Kilobytes of Instruction and 16 Kilobytes of Data Level-1 on core cache, 128 Kilobytes of shared Instruction and Data Level-2 cache per core, and 48 Megabytes of Level-3 on-chip cache (32 cores total – 256 vcpus/threads)
- 1024 Gigabytes of Memory (~364 GB used at peak load)

One Oracle ZFS Storage ZS3-2 Appliance was used for Database data storage. The storage servers were equipped with the following:

- 40 × 300 GB 10K RPM SAS-2 HDD
- 8 × Write Flash Accelerator SSD
- 2 × Read Flash Accelerator SSD 1.6 TB SAS

One Oracle Server X5-2L was used for redo log files.

- 2 × 2.4 GHz Intel Xeon E5-2630 v3 Eight-Core processors
- 32 Gigabytes of Memory
- 4 × 1.6 TB NVMe SSD

Application Server(s):

2 × Oracle Solaris Zones with 32 cores total on an Oracle's SPARC M7-8 server were used as the application servers in each LDom. They were equipped with the following:

- 1 × 4.13 GHz SPARC™ M7 Thirty-Two Core processors each with 16 Kilobytes of Instruction and 16 Kilobytes of Data Level-1 on core cache, 128 Kilobytes of shared Instruction and Data Level-2 cache per core, and 48 Megabytes of Level-3 on-chip cache (32 cores total – 256 vcpus/threads)
- 1024 Gigabytes of Memory (~347 GB used at peak load)

In the application tier, 5 PeopleSoft domains with 350 application servers (70 per each domain) were hosted in the two separate Oracle Solaris Zones for a total of 10 domains with 700 application server processes.

One Oracle Server X5-2L was used for App. objects cache.

- 2 × 2.4 GHz Intel Xeon E5-2630 v3 Eight-Core processors
- 32 Gigabytes of Memory
- 4 × 1.6 TB NVMe SSD

Web Server(s):

1 × Oracle Solaris Zone with 7 cores on an Oracle's SPARC M7-8 server was used as the web server in each LDom. It was equipped with the following:

(1 zone was configured with 32 Web Logic instances with 1 GB heap size.)

- 1 × 4.13 GHz SPARC™ M7 Thirty-Two Core processors each with 16 Kilobytes of Instruction and 16 Kilobytes of Data Level-1 on core cache, 128 Kilobytes of shared Instruction and Data Level-2 cache per core, and 48 Megabytes of Level-3 on-chip cache (32 cores total – 256 vcpus/threads)
- 1024 Gigabytes of Memory (~49 GB used at peak load)

Load Simulation Driver(s):

1 × Oracle Server X3-2 server was used as the load driver controller. It was equipped with the following:

- 2 × 2.9 GHz Intel Xeon E5-2690 Eight-Core processors, each with 2 × 6 Megabytes of Level-2 on-chip cache (16 cores total)
- 128 Gigabytes of Memory

6 × Oracle Server X3-2 servers were used as the load drivers. They were equipped with the following:

- 2 × 2.9 GHz Intel Xeon E5-2690 Eight-Core processors, each with 2 × 6 Megabytes of Level-2 on-chip cache (16 cores total)
- 128 Gigabytes of Memory

SOFTWARE VERSIONS

Oracle's PeopleSoft HRMS and Campus Solutions 9.10.00.000 with FP 2

Oracle's PeopleSoft Enterprise (PeopleTools) 8.52.03

Oracle Database 11*g* 11.2.0.3.0 (64-bit)

Oracle Solaris 11.3 (on the Database Server)

Oracle Solaris 11.3 (on the App Server and Web Server)

Java Platform, Std. Edition Development Kit 6 with Update 32

Microsoft® Windows Server 2008 R2 Enterprise Edition (on the Controller and Drivers)

Oracle ATS Load Test software 9.20.0370

Oracle (BEA) Tuxedo® 10.3.0.0 Patch Level 043 (64-bit)

Oracle WebLogic Server™ 11*g* (10.3.5)

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Enterprise HRMS 9.1 on SPARC M7-8
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